

In the Claims:

Please cancel claims 1-9, 12, 20, 21, 24-28, 30, 31, 33-39, 59, 91-93, 99 and 100. All pending claims are reproduced below, including those that remain unchanged.

Claims 1-9. Cancelled

10. (Previously Amended): A memory apparatus, comprising:

- a movable media having a surface for placing anomalies thereon;

- a moveable reading/writing mechanism, comprising:

- a moveable platform; and

- at least one fine tip portion attached to said moveable platform configured to write (cause) anomalies and read anomalies on said media surface;

- a media movement mechanism attached to said moveable media and configured to move said media in response to media control signals;

- a platform movement mechanism attached to said platform and configured to move said platform in response to platform control signals;

- wherein said at least one fine tip portion comprises a device configured to cause the formation of an anomaly on said surface;

- an i/o device having:

- an addressing port for identifying an address corresponding to an area of said media surface where data is to be one of written and read;

- an i/o port for transferring one of data to be read from and written to said media surface via said at least one fine tip portion; and

- an addressing control device configured to send control signals to each of said media and platform movement mechanisms so that said at least one fine tip portion passes an area on said media surface corresponding to an address identified at said addressing port;

- wherein at least one of said media movement mechanism and said platform movement mechanism comprises:

- an electrostatic device constructed to move at least one of said media and said platform based on an applied electrostatic potential; and

- a electrostatic control and supply device connected to said addressing control device and configured to apply an electrostatic potential to said electrostatic device to move at least one

of said media and said platform to pass said area on said media surface according to the control signals sent by said addressing control device;

wherein said electrostatic device comprises:

a series of prong sets, wherein said prong sets are attached in series such that a first of said prong sets is attached at a first end to a fixed position of said apparatus, and a second end of said first prong set is attached to a first end of a second of said prong sets, and so on, until a last (n) of said prong sets is attached at a first end to a second end of an n-1 prong set, and a second end of said last (n) prong set is attached to one of said media and said platform;

each prong set comprises a series of at least two prongs, each prong in a set is separated from other prongs of a same set by a gap, each prong constructed of at least one conductor and connected to said electrostatic supply source such that opposite electrostatic forces are applied to alternating of said prongs in a same set by said electrostatic supply; and

when said opposite electrostatic forces are applied to any of said prong sets, said gaps in the electrostatically charged prong set collapse an amount based on a magnitude of said opposite electrostatic forces causing said series of prong sets to collapse and move one of said media and said platform.

11. (Original): The apparatus according to Claim 10, wherein said electrostatic control and supply device is further configured to calculate an amount of electrostatic potential to apply to said electrostatic device.

12. (Cancelled)

13. (Original): The apparatus according to Claim 10, wherein said electrostatic device comprises:

a fixed comb having fingers protruding in an x-axis direction,

a moving comb having fingers protruding in an x-axis direction and interleaved among said fingers of said fixed comb,

bars attached to said moving comb, said bars being rigid in a y-axis direction and flexible in an x-axis direction to allow motion of said moving comb in said x-axis direction but maintaining separation of fingers of said fixed and moving combs in said y-axis direction,

a coupling rod attached to said moving comb and one of said media and said platform,
and

an electrical path connected to said fixed comb and an electrical path connected to said moving comb such that an electrical potential can be placed between said fixed and moving combs.

14. (Original): The apparatus according to Claim 13, wherein said fingers of said fixed and moving combs are notched to increase a surface area of opposing surfaces between fingers of said fixed and said moving combs.

15. (Original): The apparatus according to Claim 14, wherein said notches between said fingers of said fixed and moving combs are staggered.

16. (Original): The apparatus according to Claim 10, wherein:
at least one of said media movement mechanism and said platform movement mechanism comprises,

a comb drive, comprising,
a fixed comb having fixed fingers,
a moving comb having moving fingers interleaved between said fixed fingers,
a flex rod connected to said moving comb,
inputs connected to each of said fixed and moving combs and configured to allow application of an electrostatic force between said fixed and moving combs.

17. (Original): The apparatus according to Claim 16, wherein:
each of said fixed and moving fingers include notches; and
positions of notches on said fixed fingers are staggered with positions of said notches on said moving fingers.

18. (Original): The apparatus according to Claim 10, wherein:
said electrostatic device comprises:
a spring actuator assembly, comprising,
at least two conductive materials layered between an insulator, and

electrical paths connecting potentials from said electrostatic device to said conductive materials,

wherein said spring actuator moves in an x-direction when electrostatic forces are applied to said conductive layers, and said spring actuator is compliant at right angles (a y-direction) to said first direction, such that one of said media and said platform move freely based on said electrostatic forces in said x and y directions.

19. (Original): The apparatus according to Claim 16, wherein said actuator assembly comprises a multi-layer film of conductive patterned thin film with insulators between layers.

20. (Cancelled)

21. (Cancelled)

22. (Previously Amended): A memory apparatus, comprising:

a movable media having a surface for placing anomalies thereon;

a moveable reading/writing mechanism, comprising:

a moveable platform; and

at least one fine tip portion attached to said moveable platform configured to write (cause) anomalies and read anomalies on said media surface;

a media movement mechanism attached to said moveable media and configured to move said media in response to media control signals;

a platform movement mechanism attached to said platform and configured to move said platform in response to platform control signals;

wherein said at least one fine tip portion comprises a device configured to cause the formation of an anomaly on said media surface;

wherein at least one of said media movement mechanism and said platform movement mechanism comprises:

an thermal drive mechanism, comprising:

a set of at least one thermal actuators;

a coupling rod attached to each of said set of at least one thermal actuator

and one of said media and said platform; and

electrical paths to each of said thermal actuators;
wherein electricity supplied via said electrical paths causes a thermal expansion in said thermal actuators that moves said coupling rod;
a sensor configured to detect an amount of movement of said thermal actuators;
wherein said sensor provides feedback to a control device regulating an amount of the electricity supplied;
wherein said sensor comprises a capacitance sensor, comprising:
a fixed comb having fingers protruding in an x-axis direction;
a moving comb connected to said coupling having fingers protruding in an x-axis direction and interleaved among said fingers of said fixed comb;
bars attached to said moving comb, said bars being rigid in a y-axis direction and flexible in an x-axis direction to allow motion of said moving comb in said x-axis direction but maintaining separation of fingers of said fixed and moving combs in said y-axis direction; and
an electrical path connected to said fixed comb and an electrical path connected to said moving comb, and a capacitive measurement device configured to measure a capacitance between said fixed and moving combs.

23. (Previously Amended): A memory apparatus, comprising:
a movable media having a surface for placing anomalies thereon;
a moveable reading/writing mechanism, comprising:
a moveable platform; and
at least one fine tip portion attached to said moveable platform configured to write (cause) anomalies and read anomalies on said media surface;
a media movement mechanism attached to said moveable media and configured to move said media in response to media control signals;
a platform movement mechanism attached to said platform and configured to move said platform in response to platform control signals;
wherein said at least one fine tip portion comprises a device configured to cause the formation of an anomaly on said media surface;
wherein: said at least one of said media movement mechanism and said platform movement mechanism comprises:
a capacitive comb array comprising:

a fixed comb and a moving comb each having a set of fingers interleaved between the other set of fingers; and

capacitive outputs configured to allow a measurement of capacitance carried by said comb array;

said apparatus further comprising:

at least one thermally active block attached to said moving comb and configured to move said moving comb by thermal expansion; and

an actuator connected to said moving comb and to one of said media and said platform.

Claims 24. –28 (Cancelled)

29. (Previously Amended): A memory apparatus, comprising:

a movable media having a surface for placing anomalies thereon;

a moveable reading/writing mechanism, comprising:

a moveable platform; and

at least one fine tip portion attached to said moveable platform configured to write (cause) anomalies and read anomalies on said media surface;

a media movement mechanism attached to said moveable media and configured to move said media in response to media control signals;

a platform movement mechanism attached to said platform and configured to move said platform in response to platform control signals;

wherein said at least one fine tip portion comprises a device configured to cause the formation of an anomaly on said media surface; and

a re-planing device configured to remove at least part of each anomaly on said media surface.

30. (Cancelled)

31. (Cancelled)

32. (Previously Amended): A memory apparatus, comprising:

a movable media having a surface for placing anomalies thereon;
a moveable reading/writing mechanism, comprising:
 a moveable platform; and
 at least one fine tip portion attached to said moveable platform configured to write (cause) anomalies and read anomalies on said media surface;
a media movement mechanism attached to said moveable media and configured to move said media in response to media control signals;
a platform movement mechanism attached to said platform and configured to move said platform in response to platform control signals;
wherein said at least one fine tip portion comprises a device configured to cause the formation of an anomaly on said media surface;
wherein each fine tip portion further comprises:
 a cantilever attached to each fine tip portion; and
 an activation/pickup device connected to each cantilever;
wherein said activation/pickup device is at least one of electrostatically and capacitively activated causing said cantilever to vibrate near a resonance frequency of said cantilever; and said activation/pickup mechanism is configured to detect a phase change of vibrations of said cantilever caused by said fine tip interacting with said media surface via at least one of electrical, magnetic, and physical forces.

33. 39 (Cancelled)

40. (Previously Amended): A memory apparatus, comprising:
 a movable media having a surface for placing anomalies thereon;
 a moveable reading/writing mechanism, comprising:
 a moveable platform; and
 at least one fine tip portion attached to said moveable platform configured to write (cause) anomalies and read anomalies on said media surface;
 a media movement mechanism attached to said moveable media and configured to move said media in response to media control signals;
 a platform movement mechanism attached to said platform and configured to move said platform in response to platform control signals;

wherein said at least one fine tip portion comprises a device configured to cause the formation of an anomaly on said media surface;

a z-axis mechanism connected to at least one of said fine tip portions and said platform, wherein said z-axis mechanism is configured to place said at least one of said fine tip portions at least one of on and near said media surface;

wherein said z-axis drive mechanism comprises:

a cantilever connected to said fine tip portion at one end, and at least one set of comb fingers rotatably attached to said platform allowing movement of said cantilever and said fine tip portion in at least a z-axis direction;

at least one set of fixed comb fingers attached to said platform and interleaved between fingers of said rotatably attached comb fingers;

an electrostatic source attached to each of said fixed and rotatable comb fingers and configured to apply an electrostatic force between said fixed and rotatable comb fingers; and

a control device configured to control an amount of said electrostatic force applied to said fixed and rotatable comb fingers;

wherein, an electrostatic force applied by said electrostatic source between said fixed and rotatable comb fingers causes motion of said rotatable comb fingers and said cantilever and said fine tip portion to move in at least a z-axis direction.

41. (Previously Amended): A memory apparatus, comprising:

a movable media having a surface for placing anomalies thereon;

a moveable reading/writing mechanism, comprising:

a moveable platform; and

at least one fine tip portion attached to said moveable platform configured to write (cause) anomalies and read anomalies on said media surface;

a media movement mechanism attached to said moveable media and configured to move said media in response to media control signals;

a platform movement mechanism attached to said platform and configured to move said platform in response to platform control signals;

wherein said at least one fine tip portion comprises a device configured to cause the formation of an anomaly on said media surface;

a z-axis mechanism connected to at least one of said fine tip portions and said platform;

wherein said z-axis mechanism is configured to place said at least one of said fine tip portions at least one of on and near said media surface;

wherein said z-axis drive mechanism comprises:

a cantilever connected to said fine tip portion at one end, and at least one set of comb fingers rotatably attached to said platform allowing movement of said cantilever and said fine tip portion in at least a z-axis direction;

at least one set of fixed comb fingers attached to said platform and interleaved between fingers of said rotatably attached comb fingers; and

a capacitance detection mechanism attached to each of said fixed and rotatable comb fingers and configured to determine an amount of capacitance between said fixed and rotatable comb fingers;

wherein, said capacitance detection mechanism detects an amount of capacitance between said fixed and rotatable comb fingers to determine a z axis position of said fine tip portion.

42. (Original): The apparatus according to Claim 41, wherein said Z axis drive mechanism further comprises:

a movement device configured to move said cantilever and said fine tip portion at least one of on and in close proximity to said media surface.

43. (Previously Amended): A memory apparatus, comprising:

a movable media having a surface for placing anomalies thereon;

a moveable reading/writing mechanism, comprising:

a moveable platform; and

at least one fine tip portion attached to said moveable platform configured to write (cause) anomalies and read anomalies on said media surface;

a media movement mechanism attached to said moveable media and configured to move said media in response to media control signals;

a platform movement mechanism attached to said platform and configured to move said platform in response to platform control signals;

wherein said at least one fine tip portion comprises a device configured to cause the formation of an anomaly on said media surface;

a z-axis mechanism connected to at least one of said fine tip portions and said platform;

wherein said z-axis mechanism is configured to place said at least one of said fine tip portions at least one of on and near said media surface;

wherein said z-axis drive mechanism comprises:

a lever connected to said fine tip portion at one end;

a torsion bar connected at a second end of said lever;

an isolation bridge connected at one of said second end of said lever and said torsion bar;

a second torsion bar connected to said isolation bridge;

a moving surface connected to one of said isolation bridge and said second torsion bar; and

a fixed surface placed under said moving surface;

wherein said isolation bridge electrically isolates said lever and at least one of said second torsion bar and said moving surface and an electrostatic force applied to said fixed and moving surfaces causes said moving surface to twist at least one of said first and second torsion bars and cause at least one of said isolation bridge and said lever to move in a z-axis direction.

44. (Original): The apparatus according to Claim 43, wherein at least one of said surfaces comprises a grid.

45. (Previously Amended): A memory apparatus, comprising:

a movable media having a surface for placing anomalies thereon;

a moveable reading/writing mechanism, comprising:

a moveable platform; and

at least one fine tip portion attached to said moveable platform configured to write (cause) anomalies and read anomalies on said media surface;

a media movement mechanism attached to said moveable media and configured to move said media in response to media control signals;

a platform movement mechanism attached to said platform and configured to move said platform in response to platform control signals;

wherein said at least one fine tip portion comprises a device configured to cause the formation of an anomaly on said media surface;

a z-axis mechanism connected to at least one of said fine tip portions and said platform;

wherein said z-axis mechanism is configured to place said at least one of said fine tip portions at least one of on and near said media surface;

wherein said z-axis drive mechanism comprises:

a lever connected to said fine tip portion at one end;

a thermal bimorph, comprising a heater, and at least two materials of different expansion coefficients;

wherein a current applied to the heater raises the temperature of the bimorph, causing the bimorph to expand or contract and move said lever and said fine tip portion in a z-axis direction.

46. (Original): The apparatus according to Claim 45, wherein said heater is a poly-silicon resistor.

47-48. (Canceled)

49. (Previously Amended): A memory apparatus, comprising:

a movable media having a surface for placing anomalies thereon;

a moveable reading/writing mechanism, comprising:

a moveable platform; and

at least one fine tip portion attached to said moveable platform configured to write (cause) anomalies and read anomalies on said media surface;

a media movement mechanism attached to said moveable media and configured to move said media in response to media control signals;

a platform movement mechanism attached to said platform and configured to move said platform in response to platform control signals;

wherein said at least one fine tip portion comprises a device configured to cause the formation of an anomaly on said media surface;

a z-axis mechanism connected to at least one of said fine tip portions and said platform;

wherein said z-axis mechanism is configured to place said at least one of said fine tip portions at least one of on and near said media surface;

wherein said z-axis drive mechanism comprises:

a cantilever having said fine tip attached at a first end;

a moving assembly attached to said cantilever, comprising,

a torsion bar electrically isolated and attached to said cantilever, and
a force receiver attached to said cantilever and
configured to apply force to said cantilever;
a force applicator configured to apply force to said force receiver; and
a base configured to support said torsion bars and allow movement of said
torsion bars, said cantilever, and said force receiver upon application of said force to said force receiver.

50. (Original): The apparatus according to Claim 49, wherein:
said force receiver comprises a set of cantilever fingers;
said force applicator comprises a set of fixed fingers inter-spaced between said cantilever
fingers;
said cantilever and fixed finger are conductive; and
said force comprises an electrostatic potential applied between said cantilever and fixed
fingers.

51. (Original): The apparatus according to Claim 50, wherein:
said torsion bar is attached to said cantilever at a fulcrum point;
said cantilever fingers comprise,
a first set of cantilever fingers attached to said cantilever at the fine tip end of said
fulcrum point, and
a second set of cantilever fingers attached to said cantilever at said opposite end of said
fulcrum point; and
said fixed fingers comprise,
a first set of fixed fingers inter-spaced between said first set of cantilever fingers, and
a second set of fixed fingers inter-spaced between said second set of cantilever fingers;
said first and second sets of cantilever and fixed fingers apply forces in opposite
directions (downward and upward) causing motion of said cantilever about said fulcrum.

52-56 (Canceled)

57. (Previously Amended): A memory apparatus, comprising:
a movable media having a surface for placing anomalies thereon;

a moveable reading/writing mechanism, comprising:
a moveable platform; and
at least one fine tip portion attached to said moveable platform configured to write (cause) anomalies and read anomalies on said media surface;
a media movement mechanism attached to said moveable media and configured to move said media in response to media control signals;
a platform movement mechanism attached to said platform and configured to move said platform in response to platform control signals;
wherein said at least one fine tip portion comprises a device configured to cause the formation of an anomaly on said media surface; and
nubs placed between said media and said platform for providing a bearing for movement of said platform relative to said media.

58. (Previously Amended): A memory apparatus, comprising:

a movable media having a surface for placing anomalies thereon;
a moveable reading/writing mechanism, comprising:
a moveable platform; and
at least one fine tip portion attached to said moveable platform configured to write (cause) anomalies and read anomalies on said media surface;
a media movement mechanism attached to said moveable media and configured to move said media in response to media control signals;
a platform movement mechanism attached to said platform and configured to move said platform in response to platform control signals;
wherein said at least one fine tip portion comprises a device configured to cause the formation of an anomaly on said media surface; and
wherein said media comprises an amplifying media having electrodes at ends of said media, and a control area activated by said tip.

59. (Cancelled):

60. (Original): The apparatus according to Claim 59, wherein said media comprises a substrate having pits placed thereon, and layers of doped material and insulators covering said media.

Claims 61-93 (Canceled)

Claims 94-100 (Cancelled)